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ADDITIONAL NOTES

ON THE

GEOLOGY AND PALÆONTOLOGY

OF

OTTAWA AND VICINITY.

BY HENRY M. AMI, B.A.

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ADDITIONAL NOTES ON THE GEOLOGY AND PALÆONTOLOGY OF OTTAWA AND VICINITY.

BY HENRY M. AMI, B.A., ASST. PALÆONTOLOGIST GEOL. SURV. OF CANADA.

Read 4th March, 1885.

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Further enquiry into the varied and interesting as well as extensive series of strata exhibited in the Ottawa valley, both above and below the city, has added not a little to the sum of our knowledge already recorded in the transactions of this society and elsewhere. Both in palæontology and stratigraphy, much new to the locality, to Canada, and in some instances to science, has been discovered.

The field of research is vast and important, but fortunately a decided increase in the interest taken in geological science has marked the season just closed. No less than sixteen members of the geological section took advantage of the sub-excursions, a number of whom made collections whilst others took only a partial yet appreciative interest in the subject.

The beautiful sequence of the fossiliferous sedimentary strata, ranging from the Upper Potsdam to the Hudson River inclusive, is here well defined and may be studied to great advantage not only from a mere chronological standpoint but also in comparison with rocks considered to be synchronous with these, and deposited under rather different conditions in other portions of this continent. To trace out accurately and ascertain the degree of submergence and elevation which at different times are known to have occurred in this neighbourhood during the palæozoic period; and likewise to note the sequence of life during this same period as evinced from the *palæontological data* already obtained and still coming in, the changes in the *flora* and *fauna* corresponding to the changes of water-level, are indeed tasks worthy of a Murchison, of a Sedgwick, a Barrande, a Logan, or a Billings. Without going into details as to the result of a number of sections which have been studied from exposures in this neighbourhood, the general results obtained in the field during the past summer may be summed up as follows, the notes on each formation being given separately.

Potsdam Formation.—At Montebello, Mr. Louis J. Papineau has been carrying on extensive operations in this formation and has discovered numerous tracks of marine animals upon the sandstones which once formed an ancient sea-shore. Some beautiful slabs have been extracted.

Chazy Formation.—As has already been noticed in former transactions, the measures of this formation are clearly divisible into these series in the following ascending order: (*a*) *Sandstones*, with flags and shales; (*b*) *Shales;* (*c*) *Limestones*. The sandstones are very poor in fossils. Aylmer town and Pointe des Chenes, however, have yielded a few species, whilst a specimen of *Lingula*, as yet undetermined, but probably new, was found in the shaly division at Hemlock Lake, New Edinburgh; at Hog's Back, Nepean, some very fossiliferous beds occur, one especially noteworthy containing abundance of *Lingula Belli, (Billings)*, a Lamellibranchiate shell also undetermined and *Cyrtodonta breviuscula, (Billings.)* Numerous black phosphatic nodules, probably coprolites, are frequently associated with these.

On the occasion of the Club's visit to Moore's Landing, opposite Quyon, about 40 miles west of Ottawa, the *geological branch* had a splendid opportunity afforded them of examining a fine section of the Chazy formation. The measures at this place are exposed from the river margin to the top of the hill (with a few places of concealment) a thickness of 135 feet. This exposure can be traced down the Ottawa in an undoubted continuous series as far to the east as Skead's Mills, near Ottawa, along the Ontario shore, outcrops of which are almost everywhere to be seen, but especially about Berry's brewery and along the lake shore and at Brittania. This tract of country was geologically coloured as Calciferous in the 1866 map published by Sir Wm. Logan, but from conclusive palæontological evidence obtained at this excursion it can be positively asserted that these measures are of the Chazy formation. Deposited horizontally and even now quite undisturbed, the beds at Moore's Landing hold an abundance of organic remains in the uppermost or limestone portion of the section. The characteristic band of impure limestone teeming with remains of *Entomostraca* may also be seen here in its normal position—as at Aylmer, Hog's Back, L'Orignal, etc., from which places it has been recorded.

The species most abundant is probably the *Leperditia Canadensis, var Louckiana* (Jones.)

The associated bed of limestone exhibiting numerous and large concentric patches of rock supposed to repesent the *Stromatocerium rugosum* of Hall, is exposed along the road a considerable distance, and fine specimens have been collected of what appears to be the above species. A doubt still exists in the mind of the writer as to whether or not this bed, which is almost if not entirely composed of this organism, may not be merely the result of concretionary action. Microscopic sections of specimens prepared by Mr. Weston have not given any characteristic structure. Besides the above there were collected: *Columnaria incerta* (Billings), a fossil coral; a *Pleurotomaria* like *P. pauper* (Bill.), an *Orthoceras sp.* and *Leperditiæ* already referred to. There is but little doubt that the strip of country lying between this place and Ottawa, now occupied by the Ottawa River, and extending some distance on either bank, presented at one time a perfectly flat and continuous aspect.

Denuding agencies have evidently been at work in forming the bed of the Ottawa River and also to a certain extent Lake Des Chénes —agencies which during the "glacial epoch" must have been much more active than the present slow but sure denuding action of subaërial or atmospheric erosion.

Another very typical exposure of the Chazy formation was observed and examined to the eastward of the Rideau Hall grounds close to where the measures of the Trenton formation, characterized by the abundance of fossils peculiar to that horizon, and considerably disturbed owing to a local fault, come in contact with it.

The characteristic bed of concretionary (?) or laminated limestone is well exposed over a considerable area in the country lying between Mr. Matheson's property and the Rideau Hall grounds, occupying the superior portion of the measures throughout the greater part. This area, as at present known, presents an irregular contour bounded on almost every side by faults and dislocations of purely local origin, bringing the measures of the Chazy in contact with those of the Black River, Trenton, and Utica (?) formations—showing how intricate and at the same time interesting the geology of Ottawa is.

Besides affording good sandstone and limestone for building purposes and also flagstones for paving: the Chazy formation about Ottawa affords good hydraulic cement. On lot 34, Con. A, Nepean, Mr. C. B. Wright has opened a large quarry in three beds lying close to one another in the uppermost part of this formation, and for years past has obtained a large quantity of a magnesian limestone having a marked conchoidal fracture and often containing small cavities lined with pink calcite crystals. Higher up the river and on the line of strike of the above mentioned exposure the same beds were noticed at several places, whilst in the "Geol. of Canada," 1863, page 806, it is stated that they are continuous from Allumette Island to Hawkesbury, a distance of over 100 miles. The cement, known commercially as the "Hull Cement" and manufactured by calcining this rock with an admixture of clay as the argillaceous constituent required in certain definite proportions, has been characterized as "a strong and lasting cement"—(see descriptive catalogue of the minerals of Canada—Dr. Selwyn, 1876.) The clays used belong to the post tertiary epoch and are of marine origin, being known as the "Leda Clays."

There has been a considerable demand for "Hull Cement" in foreign as well as home markets during the past year, upwards of 8,000 barrels of hydraulic cement having been shipped from this port whilst there have already been extracted 1,750 loads of cement-stone this winter for calcination during the coming season. The cement belongs to that class known as "slow-setting."

Bird's Eye and Black River Formation.—The measures of this formation about the Petite Chaudiere on the north and south shores of the Ottawa River were visited and a number of the characteristic species of fossils collected, e. g. : *Columnaria Halli*, (Nicholson), *Tetradium fibratum* (Safford), etc.

Notes were taken on the much faulted and disturbed strata at this locality which assumes its peculiar orographic aspect on account of faults cutting the measures in a parallel series of steps—whence the rapids.

It is very difficult to ascertain in many instances the exact amount of faulting, yet the exposures are most interesting and deserve close study.

Proceeding eastward from the city we find another interesting exposure of this formation occurring at the branching of the road leading to Beechwood cemetery, close to the swamp. Here a very interesting section may be seen showing the contact of this formation with the Utica, indicating the presence of a local fault or dislocation apparently causing a downthrow on the west side of the fault of at least 200 feet. This fault is a remarkable one, and can be traced to a distance of two miles on the Ontario side, traversing the country in an approximate north and south direction, crossing the swamp above referred to, and may be seen bringing the measures of the Trenton at a high angle to the horizon on the east side of Mackay's Bay. The Black River formation here, as in other places about Ottawa, is characterised by beds of dark blue and grey impure limestone affording good building stone, almost throughout its whole measures. At this exposure the lower measures of the formation are tilted at an angle of 90° where they come in contact with the Utica formation, then proceeding eastward the beds are seen to dip at various angles to the east, the angle gradually decreasing until the summit of the bluff and the cemetery are reached, where they are practically horizontal, dipping but slightly to the east.

Amongst the organic remains found here may be mentioned *Tetradium fibratum* (Safford), *Helicotoma plumulata* (Salter), *Pleurotomaria lapicida* (Salter), besides lamellibranchiata and bivalve entomostraca in great numbers requiring further study.

Trenton Formation.—In this tolerably well known and interesting formation some points of interest are always sure to come up, both as regards its palæontological record and local stratigraphical significance. At Ottawa and vicinity the Trenton, like its closely related formations, is affected by a number of faults, and it has been pretty conclusively ascertained from flexures in the strata, accompanied by faults, exhibiting what is generally termed a monoclinal structure, or simply a "monocline"—that there has been in most instances a downthrow on the west side of the faults, which have a general north and south bearing at right angles to the course of the Ottawa River. The Trenton formation, as exposed at Nepean Point and old "Barrack," or now "Parliament Hill," presents many interesting faults and flexures.

Among the fossil remains worthy of note collected at the foot of Parliament Hill may be mentioned a large sponge referred by Mr. Whiteaves to the genus *Brachiospongia* (Marsh.) This beautiful specimen was obtained by the writer above low water mark in a bed of limestone six inches in thickness, and immediately overlying that containing tracks or trails of marine animals, at one of the geological sub-excursions of the Club, Dr. Baptie being present. It is the first time that the genus has been recognized as occurring in Canada. This Ottawa specimen measures 10 inches or 24·5 centimetres in diameter, and presents seven "brachia," or "arms"—so called. These lobes, more properly speaking, are seen to radiate from a broad circular central portion. There appear between these, in the intermediate spaces, lobes slightly elevated above the general level of the others; whether these are structural or not has not yet been ascertained. The specific reference is still doubtful as microscopic sections carefully prepared by Mr. Weston, of the Geological Survey, have not given definite structure. In certain minor details our specimen differs from either of the three species described by Profs. Owen and Marsh, from the Cincinnati group of Ohio, and whether they are all the same or different species, still remains to be settled.

Associated with it was discovered a series of tracks, probably made by mollusca, resembling in miniature those described by Billings as *Scærichnites*, from the Cambro-Silurian deposits of Anticosti. That they are not referable to Billing's species, *S. abruptus*, is at once evident by comparing the specimens with the description.

The Ottawa specimens are often tortuous in their course, the marks or pits are arranged in an alternating manner, and about three-eighths of an inch is the greatest width of these tracks, there being about twelve steps or series of footprints in the space of twenty-four lines. Ichnites like these are generally supposed to have been molluscan in origin. Amongst the other species of interest collected at the same sub-excursion may be mentioned as of more especial interest, *Ophileta Ottawaënsis* (Billings), *Strophomena deltoidea* (Conrad), *Bucania bidorsata* (Hall), &c. Besides the above, the Trenton formation has also yielded *Amplexopora Canadensis* (Foord), *Pholidops subtruncatus* (Hall), *Illænus trentonensis* (Emmons), a *beyrichia* very difficult to distinguish

from some of the Cincinnati group species described by Prof. S. A. Miller, as well as a number of species awaiting identification.

A very interesting sub-excursion of the club was held at a short distance from the city in July last, when the writer, in company with Messrs. Craig, Summerby and Dr. Loux, all enthusiastic members and devotees to science, visited a number of interesting exposures in the county of Russell. The Trenton was observed to crop out on the 10th lot of con. 10, Russell, and lot 30 of con. 5 of Cambridge, forming a ridge or elevation above the general level of the country, the measures dipping at an angle of about 15° to the north. There may be a dislocation here, but the exposures were too limited to ascertain. The strike is almost due east and west. Farther up, at Cook's Rapids, on the River Castor, lot 8, con. 9 of Russell, was found a splendid exposure of the Trenton formation for a distance of at least one mile, characterized by abundance of fossils, over twenty species having been collected and recorded from that place, amongst which may be mentioned the *Brachiospongia* referred to already, *Protarea vetusta*, *H. Prasopora Selwyni* (Nich), *Bellerophon sulcatinus* (Billings).

The Utica Formation.—To sum up briefly the results obtained in the very interesting series of bituminous schists and associated impure limestones, it may be said that in the exposures on the Rideau Hall grounds the perfectly conformable position of the Utica on the Trenton, or else the gradual passing of the Trenton measures into those of this formation is very evident. That an unconformability has been assigned to the Utica by many authors is a well-known fact. The measures at Rideau Hall immediately set at rest this question upon examining them. Not only the stratigraphy agrees, but also the mass of palæontological evidence which has already been gathered from this formation, enables one to satisfy himself of the truths of the above statement. There is no discordance of stratification whatever, and, further, there are species and genera which pass from one into the other gradually. In fact it is very difficult, nay, impossible, to give the precise bed which is first characteristic of the Utica.

The uppermost measures of the Trenton have shales between the layers of limestones; the sediment having assumed a more argillaceous

nature, owing, no doubt, to a depression of the continent and consequent greater depth of the seas in the Utica times.

An important fact has been ascertained with regard to the distribution of the Utica at Ottawa, viz., that it occurs on Bank street, just west of the fault, which runs by the "Supreme Court" building. The Utica was further ascertained to occur on Albert street, from the corner of Kent, 175 feet in an easterly direction, having had to be blasted by the men employed in laying drains, &c. From these shales some beautiful specimens were obtained. The rocks here present a striking resemblance to those of a similar horizon at such a remote distance as Collingwood, on the Georgian Bay. The association of the trilobites, mollusks and bivalve shells, and entomostroca is strikingly the same. *Lyrodesma pulchellum*, *Leperditia cylindrica*, *Asaphus Canadensis*, *Triarthrus becki*, *Lingula Pr[illegible]ne*, *Leptobolus insignis* and *Endoceras proteiformis*, all occurring together in same beds both here and at Collingwood in Western Ontario. Amongst the additions to the list of Utica species may be mentioned a new species of monticuliporid—*Batostoma erratica*, Ulrich, MSS. From beautiful sections of this interesting branching polyzoary prepared by Mr. Weston and from drawings executed by the same gentlemen, together with Mr. Ulrich's authority, the writer has had an opportunity of identifying the species in question. Prof. Ulrich will soon describe it, and therefore no description is here given of it. It has further been ascertained that the graptolites referred to as *Didymograptus flaccidus* and *annectans* are both referrable to the genus *Leptograptus*.

Hudson River Formation.—Here we have to hail a new era in our geological nomenclature, having to add this formation to the eight others already known about Ottawa, and with which the Club's work has dealt. That the shales and arenaceous beds found on a cutting on the Canada Atlantic railway are of this age may be ascertained from the following list of species found. The cutting is three miles from Ottawa. *Zygospira headi*, *B.* (*O. Erratica*, *H.*), *Orthis testudinaria*, and *Aspidopholis*, *Modiolopsis modiolaris*, Conrad (*large*), *Modiolopsis pholadiformis* (Hall), *Ambonychia radiata* (Hall) &c., *Cyrtolites ornatus* (Conrad), *Bellerophon bilobatus*—G. B.

pectinella.

In the post tertiary deposits of Green's creek the writer, in company with Mr. F. A. Dixon, found an interesting coleopterous insect, which is now in the hands of Prof. S. H. Scudder, of Boston, and awaits identification.